A Tool for Developing Computer-Based Examinations

Michael D. Collins, Ph.D., Michael Altman, M.D.
Northwestern University Medical School, Chicago, IL

The administration of examinations by computer offers significant advantages both in the structuring of the examination itself and in the manipulation of data derived from the examination. This is particularly important in the present era of curricular reform that emphasizes student-directed learning and higher processes than mere rote learning; these educational strategies require more authentic assessment than traditional examination formats permit.

We have attempted to resolve this dilemma by designing an examination development tool which allows educators to go beyond the simple multiple choice question (MCQ) and to develop examination items that more closely assess higher cognitive processes. This tool permits the creation of these question types:

- •scrolling extended MCQ
- •MCQ based on images, movies, or sound
- •embedded hot areas within graphics
- •branching MCQ series
- •freetext answer

Extended MCQ reduces the cueing provided by traditional five-choice questions and more closely simulates recall testing. Scrolling fields make this possible while conserving computer screen space. MCQs coupled with graphics and even movies permit a richer but economic testing environment. "Hot" areas within graphics allows better testing of student understanding and recognition by eliminating visual clues provided by labels or tags. Branching strategies link a question to a previous answer, permitting the assessment of the pathway a student may take through a problem. A set of questions can thus be tailored to a student's reasoning process and permit both the assessment of that process and the student's knowledge within the process. By seeking requisite key words, the computer can score examination items that require the student to enter answers as free text.

The application permits randomizing the ordering of items within an examination so that each student encounters the questions in a unique order. The individual examination is not scored until the student indicates completion; students may return to items and alter choices at any time.

The examination tool also contains an array of statistical analysis capabilities that provide overall scores, mean scores and standard deviation, scores by category, histograms, and biserial correlation coefficients of each item. If needed, the tool permits discarding of an item and recalculation of results.

The application is written in HyperCard® 2.3, running exclusively in a Macintosh® environment; a Windows™ run-time version should be available in late 1996. Incorporating external functions, the application extends the functionality and speed of HyperCard. There are three separate components:

- The Test Generator Tool converts text files into a test application and also includes a graphic mapping tool for the inclusion of graphics with hot areas.
- The Test Application is the user interface for taking the exam.
- The Results Tool gathers the data from the Test Application and has statistical analysis capabilities.

The application runs in a client/server environment. Built-in crash protection ensures that if the application crashes during an examination a student's answers will be saved and can be restored.

This examination development tool was first tested by the entry and administration of examinations formerly given on paper. Subsequently, faculty have worked with the developers to create and administer more complex examinations utilizing the full capacity of the tool.

0195—4210/96/$5.00